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Adoption behaviour of conservation based improved marigold cultivation in tribal villages of southern Odisha

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ABSTRACT

A study was conducted in six villages of Koraput district of southern Odisha for three years (2011-2013) under front line demonstrations (FLDs) program of Krishi Vigyan Kendra (KVK), Semiliguda to assess the knowledge and adoption level of scientific marigold cultivation through variety 'Seracole Orange'. The knowledge level and perception were analysed for 120 farmers in six villages (20 farmer's village^{-1}). The analysis revealed that majority of the marigold growers were possessing medium (58%) to high (34%) level of knowledge of scientific marigold cultivation. Age of cultivators exhibited negative correlation with marigold adoption. However, regression analysis shown that among different independent variables, education, occupation status, training, annual income, attitude towards flower cultivation and extension contact had a significant positive contribution towards adoption of improved marigold cultivation. Among different villages, Malidoliamba village steadily performed better along the years and recorded maximum yield (92.8 q ha^{-1}) in 2011. An average yield of 40.7, 42.6 and 40.6 q ha^{-1} was recorded in distantly located villages Luhaba, Kanjaimaliguda and Jhaliaguda, respectively which comprises of uninformed farmers. On mean value basis, villages like Malidoliamba, Tentuliguda and Durkaguda recorded B:C ratio of 2.31, 2.12 and 2.40, respectively. On an average, additional investment of ₹ 8,142 ha^{-1} was made under demonstrations in different villages which gave average additional net returns of ₹ 40,851 ha^{-1} over farmers' practice (FP). On mean value basis of all villages, the water use efficiency (WUE) under improved marigold cultivation was 68.5, 65.88 and 66.72% higher than local practice (FP) in 2011, 2012 and 2013, respectively. Marigold cultivation consultancy pattern of farmers revealed that KVK is the preferred source of knowledge closely followed by the local agriculture seed shop. The findings of this research imply that rural youth, young farmers and school dropouts should be given adequate technical support by training and education so that they could adopt scientific marigold cultivation for better livelihood prospects.

Key words :
Adoption behaviour,
Consultancy pattern,
Correlation,
Marigold,
Water use efficiency

1. INTRODUCTION

Floriculture is one of the important high value agricultural industries in many countries of the world. The global exports increased over ten folds from 0.5 billion in 1995 to 5.1 billion in 2005 and such again is poised to double by 2025 (Singh *et al.,* 2010). India has a long tradition of floriculture but its share in the global market is only 0.65% (US $11 billion). The total area under cultivation of different flowers in India is 0.10 m ha and the production expected in cut flowers is 80 mt (Anonymous, 2014a). India seems to be a dormant giant, a country with immense potential to emerge as front-runner in global trade but lagging behind in the regular crop husbandry.

Southern Odisha encompasses a series of mountainous region comprising of hillocks, sloping lands and fertile flat lands. It covers an area of 4.87 m ha in 36 blocks of 6 south-

western districts with a population of 2.13 million (Sikka *et al*., 2000, Dass *et al.*, 2009). Rainfed uplands situated between hillocks and valleys constitute a major portion of arable land and contribute immensely to food production of the region. The slopes of such lands vary from 2 to 15% (Dass *et al*., 2011) and thus are under heavy water erosion induced soil and nutrient losses leading to severe land degradation and low crop productivity. The land holdings in the region are predominantly small and marginal. The *Mali* tribal community of the region is traditionally engaged in vegetable cultivation and with improving connectivity to market they are now fast catching up with floriculture. Flowers are an integral part of tribal culture and the tribal of Koraput region are fond of flowers. They adore the flowers on every festive occasion, dancing and during visit to fairs. Among flowers, marigold occupies a noteworthy place keeping in view its longer shelf-life, rough packaging and transportation.

Farmers customarily raise local varieties of African marigold in backyard on small-scale, farmers sell flowers and get remunerative price. Marigold is mostly grown as borderline crop with brinjal, garlic, tomato, radish, beans, cauliflower *etc.* Farmers have also reported reduction in pest load as marigold acts as pest deceiver. There is also growing demand for flowers from nearby townships like Sunabeda, Damanjodi, Koraput, Jeypore and even transported to distant markets like Salur (100 km), Jagdalpur (95 km), Raipur (350 km), Vizainagram (140 km) and Vishakhapatnam (180 km). Most of the varieties are suitable for cultivation during winter season, but during *kharif* and summer season, there is shortage of flowers even though there is equal demand in various festivals like Ganesh Puja, Durga Puja, Deepawali, Shivratri, Holi, Rathyatra and marriages.

African marigold variety 'Seracole Orange' is released from West Bengal and popularised under National Horticulture Mission as off-season crop in uplands of eastern India. The flowers are compact with beautiful orange colour having good keeping quality. It can be propagated by seed which is a boon for farmers in marigold cultivation. Most other varieties of marigold do not have viable seeds; hence they are propagated by cutting which is cumbersome for farmers. In one of the trials conducted in different parts of Odisha reported an advantage of 59.7% in comparison to local marigold in Jajpur district with average yield of 206 qha^{-1} (Anonymous, 2013). In another trial, Maharana *et al.* (2012) in their studies in Koraput district reported net profit of ₹ 1750 from a small patch of 200 m^2 with a B:C ratio of 1.20. They concluded that cultivation of marigold variety 'Seracole Orange' with improved practices can play an important role in livelihood enrichment in this tribal area.With this background, an extension study was planned with the objective to find out the knowledge and adoption of improved marigold cultivation with variety 'Seracole Orange' in this tribal region of Odisha.

2. MATERIALS AND METHODS

Study Area

Southern Odisha comprises of amalgamation of hilly region of Andhra Pradesh, Chhattisgarh and Odisha. In order to assess the scope and constraints of marigold cultivation, a number of field level demonstrations (FLD's) were conducted during 2011-13 in 6 villages representing different blocks and wide geographical area of Koraput district (Fig. 1). Since the operational area of the KVK, Semiliguda is Koraput district, the adaptive research program was restricted only to this district which although represents the socio-agro-economic as well as agro-climatic conditions of southern Odisha. Resource poor farmers of the region do not have any remunerative livelihood except cereal monocropping. In contrast, the undulating physiography of region merely supports rainfed upland agriculture. The popularization and adoption of marigold cultivation in *kharif* can compensate resource poor farmers of the region to raise family income and earn better livelihoods.

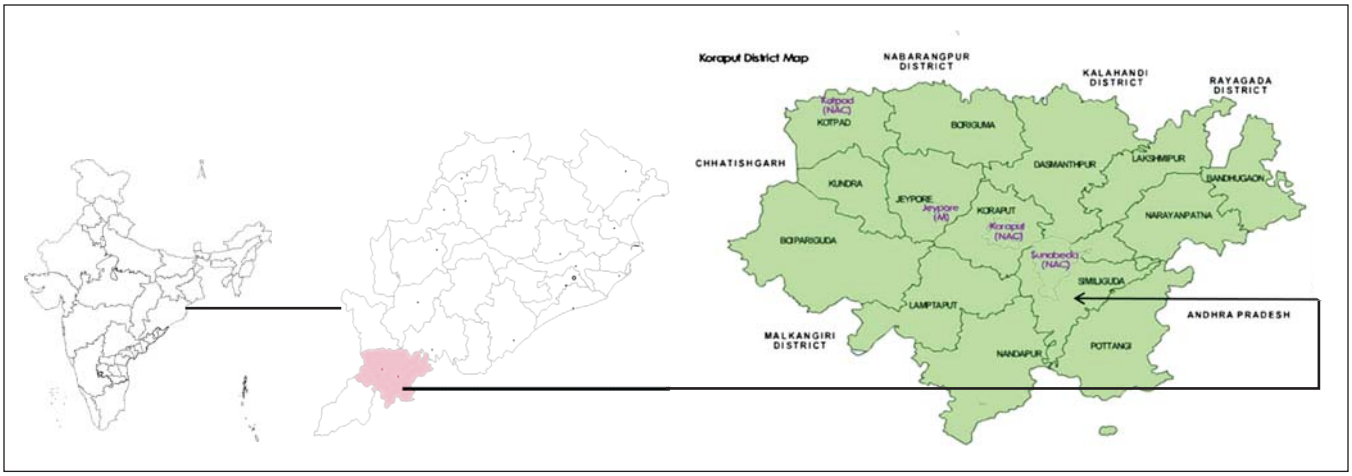

Fig. 1. Location of the study area

Selection of Villages and Farmers

The KVK conducted an investigation in the target area to assess the marigold cultivation on sloping physiography of Koraput district. The study was conducted as on-farm trial (OFT) followed by FLD's with marigold variety 'Seracole Orange' in four villages of Semiliguda block *viz.,* Malidoliamba, Tentuliguda, Durkaguda, Luhaba and two villages, Kanjaimaliguda and Jhaliaguda of Jeypore block during 2011-13. These villages were selected purposefully where marigold cultivation is popular along the linking roads. Twenty flower growers from each of the six villages were selected by using simple random sampling technique and thus, a total of 120 flower cultivators were included in the study.

Data Collection and Statistical Analysis

The data was collected through survey method. The major tools used for data collection were exhaustive village survey, interview schedules (structured and semi-structured), in-depth discussion and secondary data sources. Taking into consideration the scope and objectives of the study, a well-structured interview schedule was prepared. Based on the result of pre-test, suitable modifications were made and a final interview schedule was prepared. All the collected data was coded following the methodology suggested by Bhairamkar *et al.* (2011) and tabulated for statistical analysis.

Physiological and communication variables *viz.,* risk, attitude and motivation were judged on a quantitative scale in which feedback of the farmers was quantified on the scale of 1 to 5 starting with 'strongly agree' to 'strongly disagree' (higher value). Further, the data was analysed for correlation and regression analysis at 1 and 5% significance level. The statistical tools and tests such as frequency, percentages, mean and standard deviation were used wherever found appropriate and data were analyzed systematically to draw valid and reliable inferences.

Water Use and Water-Use Efficiency

The seasonal water use was computed from profile water contribution (CS), effective rainfall (ER) and irrigation water applied (I) using the following equation:

$$\text{Water use} = CS + ER + I$$

As the FLD's were conducted in a wide area of two different blocks of Koraput district, the profile water contribution (CS) was not taken into consideration both in demonstration and farmers' plots. Marigold crop was raised under rainfed conditions only. Thus, effective rainfall was considered as seasonal water use in the present study by taking into account the respective crop growth period of each demonstration (Choudhary and Suri, 2014) and water-use efficiency (WUE) was worked out accordingly. The rainfall data of Semiliguda and Jeypore block (Fig. 2) were collected online from Odisha Agrometeorology Services (Anonymous, 2014b).

Economic Analysis

Cost of cultivation of improved marigold cultivation included cost of inputs, such as seed, fertilizers and pesticides purchased by the farmers (in farmers' practice) and supplied by the Farm Science Centre - KVK (in demonstration plots) as well as hired labour (if any), sowing charges by bullocks/tractor and post-harvest operation cost paid by farmers. The farmers' family labour was not taken into consideration in the present study. The gross and net returns were worked out accordingly by taking into account the cost of cultivation and sale price of the produce. Additional cost has included expenditure on improved technological inputs in FLDs over farmers' practice.

3. RESULTS AND DISCUSSION

Knowledge Level of Farmers about Improved Marigold Production Technology

The knowledge level and perception of improved marigold cultivation was analysed amid farmers of different villages. Farmers' feedback was categorised into low, medium and high categories based on the score. The total adoption score for each farmer was computed by adding up the scores of all 18 point package of practice of scientific marigold cultivation (Table 1). The mean score for knowledge was 14.5 out of maximum score of 18. Majority of the marigold cultivators were found to have medium (48%) to high (28%) level of knowledge of flower cultivation technology followed by low (23%) score. Since

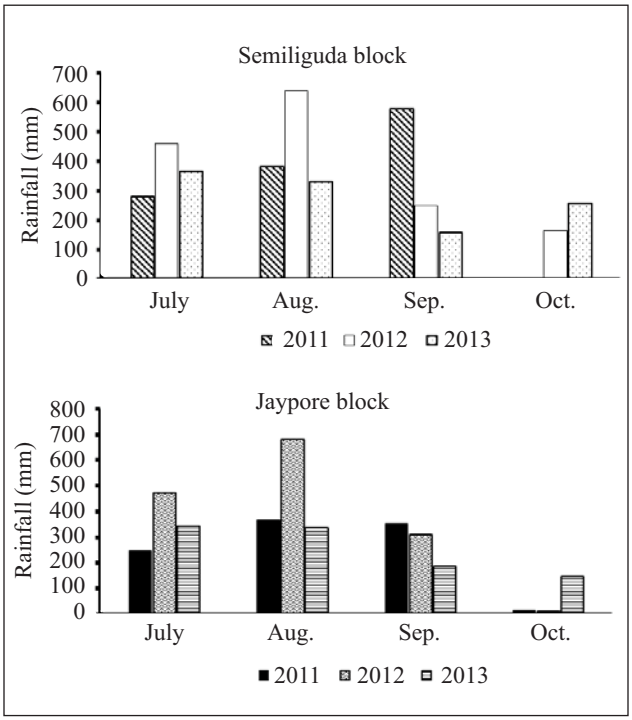

Fig. 2. Monthly rainfall during crop growth in the study area

Table: 1
Knowledge level of farmers and extent of adoption of improved marigold cultivation in different villages (n = 120)

Knowledge level	Malidoliamba	Tentuliguda	Durkaguda	Luhaba	Kanjaimaliguda	Jhaliaguda	Average
High (> 14)	9 (45)	7(35)	5(25)	3(15)	5(25)	5(25)	34(28)
Medium (9 to 14)	9(45)	9(45)	9 (45)	11(55)	11(55)	9(45)	58(48)
Low (< 9)	2 (10)	4(20)	6(30)	6(30)	4(20)	6(30)	28(23)
						Mean	40
Note: Figures within the parentheses are % to total farmers (n) from respective village Standard deviation							15.87

marigold is cultivated on marginal scale, very few cultivators were having high level of knowledge in this tribal region. In spite of that, 75% of the flower cultivators were having either high or medium level of knowledge. Form this analysis it can be concluded that marigold cultivation has boosted confidence level of the cultivators in this area. This is an encouraging finding and further efforts should be made to bring the same trend for other categories.

Package of Practices wise Adoption

The marigold cultivation technology was sub-divided into 18 point practices starting from across slope cultivation to packing. On these 18 practices, feedback of farmers was obtained and adoption was seen for each practice. The responses of the farmers were divided into low, medium and high groups (Table 2). It was found that majority of the respondents (97) were adopting across the slope cultivation of marigold, intercultural operations (92), proper time of harvesting (98) and time of sowing (78). A medium level of adoption was seen for recommended seed rate (39), nursery raising (70) and packing of flowers (57). The critical practices like seed treatment (54), fertilizer dose (53), pinching operation (111), pest management (85), disease management (94) and shelf life treatment (112) scored maximum in low level of adoption in comparison to other practices. The results of the study are in agreement with the findings of Tomar *et al.* (2003) and Gowda *et al.* (2006).

Relationship between Adoption of Improved Marigold Cultivation and Selected Variables

Relationship of adoption behaviour with socio-personal, economic, psychological and communication variables of marigold cultivators were studied using multiple correlation and regression coefficients. The values designated in Table 3 show the degree of acceptance of marigold cultivation technology. These were found to be positively and significantly correlated with their education, training, extension contact and mass media exposure.

Age of cultivators (120) was having negative but significant correlation with marigold adoption at 1% level of significance. This communicates that younger the farmer higher is the adoption. However, rest of the variables *viz.,* caste, family size, occupation status, land holding and social participation were found to be non-significant. Education status of farmers led to high adoption rate, specifying that

Table: 2
Recommended package and practice wise adoption of improved marigold production technology

S. No.	Particulars	Adoption (n =120)		
		Low	Medium	High
1	Across slope cultivation & SWC measures	5	18	97
2	Use of improved varieties	29	23	68
3	Time of Sowing	14	28	78
4	Nursery raising	31	70	19
5	Seed treatment (Bavistin @ 0.2%)	54	36	30
6	Seed rate (1 kg ha^{-1})	10	39	71
7	Spacing- 40 × 30 cm	12	35	73
8	Fertilizer dose (NPK-200-100-100)	53	35	32
9	Time of fertilizer application (split doses)	30	46	44
10	Intercultural operations	8	20	92
11	Disease management - Bud rot	94	18	8
12	Pinching operation (45 DAT)	111	5	4
13	Pest management	85	20	15
14	Time of harvesting	9	13	98
15	Method of harvesting	21	25	74
16	Post-harvest management	30	65	25
17	Flower packing	35	57	28
18	Higher shelf life (Aluminum sulphate solution 0.3%)	112	5	3

Table: 3
Relationship between improved marigold cultivation adoption and socio-personal selected independent variables and their contribution in explaining the variability in adoption (N=120)

S. No.	Socio-personal-economic variables	'r' value	'b' value
1	Age	-0.927**	0.107 NS
2	Education	0.637**	0.834**
3	Caste	0.040NS	0.968 NS
4	Family size	0.001 NS	0.638 NS
5	Occupation status	-0.154 NS	-0.886*
6	Land holding	0.046 NS	0.010 NS
7	Social participation	-0.142 NS	-0.138 NS
8	Training	0.786**	2.247*
9	Experience in flower cultivation	-0.139 NS	-0.597 NS
10	Annual income	0.939**	0.001*
	Psychological variables		
11	Risk orientation	0.676**	-0.623 NS
12	Attitude towards Flower cultivation	0.694**	1.244**
13	Economic motivation	0.056	-0.362 NS
	Communication variables		
14	Extension contact	0.934**	2.907*
15	Mass media exposure	0.714**	-0.042 NS

NS - Non-Significant; **Significant at 0.01 level of probability;
*Significant at 0.05 level of probability

more educated the farmers greater is the adoption level. Annual income of the farmers also exhibited high degree of correlation with marigold adoption (0.94), which implies that financial security gives an impulsion to farmer for exploring new avenue in agriculture and allied activities. One additional variable registering significant correlation was training experience (0.78). From the correlation findings, it is concluded that training and skill development had significant impact on farmers' adoption and marigold yield. Thus, the extension strategy should be of targeted approach for training the young farmers who had high adoption rate of marigold cultivation technology and old age group farmers should be educated regarding new innovations. Dass *et al.* (2008) also observed better response of young farmers towards adoption of mushroom cultivation in the tribal watershed, Kokriguda located in the Koraput region.

Among physiological variables, risk orientation and scientific attitude towards flower cultivation registered significant correlation values of 0.67 and 0.69, respectively. This displays farmers risk bearing ability along with scientific attitude can be diverted from the traditional monocropping practices to modern cultivation practices like marigold to fetch premium price and profits. A study of the communication variable shows that extension contact and mass media exposure play significant role in improvement and adoption of scientific marigold cultivation. A positive significant value of extension contact and mass media exposure to the tune of 0.93 and 0.72, respectively endorses this perception. The results of this study are in line with the observations of Verma *et al.* (2013a).

The regression analysis reveals that among different independent variables, education, occupation status, training, annual income, attitude towards flower cultivation and extension contact had a significant positive contribution towards adoption of marigold cultivation. Contrast to correlation values; intercept (b) values of variables like age, risk orientation and mass media exposure were non-significant. However, occupation status, training and extension contact showed higher significance values to the tune of -0.88, 2.25 and 2.91, respectively. The finding endorses the work of Sajeev and Saroj (2014).

Performance of FLD

Economics of marigold cultivation under FLD's was appraised on prevailing market prices. All the variable costs were considered in calculating the cost of cultivation of marigold and the results are presented in Table 4. Outcomes reflect that owing to improved seed and technical follow up, the mean demonstration yield (31q ha^{-1}) is pointedly higher over farmers' practice, resulting in mean additional profit of ₹ 8,142 ha^{-1} across the six villages.

Malidoliamba village has consistently performed superior along the years (2011-13) and recorded maximum yield (92.8 q ha^{-1}) in 2011. Distant villages like Luhaba, Kanjaimaliguda and Jhaliaguda inhabited by uninformed farmers exhibited low marigold yields. On an average, yield of 40.7, 42.6 and 40.6 q $ha^{-1}$was recorded in Luhaba, Kanjaimaliguda and Jhaliaguda, respectively. Economic returns are function of yield and sale price which varied along the years in different villages. Maximum net returns of ₹ 91,441 ha^{-1} were obtained during the year 2013 both under demonstration plots as well as farmers' practice, respectively in Malidoliamba village. On mean value basis, high yielding villages, Malidoliamba, Tentuliguda and Durkaguda recorded B:C ratio of 2.31, 2.12 and 2.41, respectively. However, the cost of cultivation for demonstration plots was more in comparison to farmers' practice due to use of greater kinds and amounts of inputs in improved cultivation of marigold. Higher B:C ratio under demonstration plot directs marigold cultivation as a profitable enterprise having better marketing scenarios.

Additional gain in yield, cost of cultivation, and net returns in the six villages of FLD's are presented in Fig 3. Durkaguda village performed best recording maximum additional yield of 41.4 q ha^{-1} with additional net returns of ₹ 54,829 ha^{-1}. These variations in the economic returns in different villages are attributed to the variations in the yield of marigold cultivar under improved practices. On the other hand, Luhaba village performed poorly with a partly increase of yield and net returns to the tune of 22.1q ha^{-1} and ₹ 24,491 ha^{-1}, respectively.

On an average, additional investment of ₹ 8,142 ha^{-1} made under demonstrations in different villages returned average additional net returns to the tune of ₹ 40,851 ha^{-1} compared to farmers' practice. This could be ascribed to high additional return and low additional cost in that particular year (Verma *et al.,* 2013b). Enhanced monetary returns in terms of gross, net, and additional returns as well as enhanced BCR through improved farm technology have also been reported by various workers (Vedna *et al.,* 2007). Overall, economic analysis data showed that transfer of improved technology of marigold cultivation and its adoption may substantially enhance the productivity and farmers' profitability besides providing a better livelihood option for farmers under rainfed farming in tribal region of Odisha.

Resource Conservation

The farmers in the Koraput region are practising agriculture on slopping lands since time immemorial. Conservation of natural assets like soil and water are in their traditional knowledge as noticed during the survey. Watershed development program, human resource development activities and training by various government agencies, non-government organisations (NGOs) and other extension agencies are making the farmer cognizant

Table: 4
Economics of frontline demonstrations

Year/Village	Yield (q ha^{-1})		Cost of cultivation (₹ ha^{-1})		Net returns (₹ ha^{-1})		B:C ratio	
	Demo.	FP	Demo.	FP	Demo.	FP	Demo.	FP
Malidoliamba								
2011	92.8	53.5	61,248	48,150	59,172	24,075	1.97	1.50
2012	86.8	55.5	57,288	49,950	81,432	38,850	2.42	1.78
2013	90.2	55.8	59,532	50,220	91,441	47,430	2.54	1.94
Mean	89.9	54.9	59,356	49,440	77,348	36,785	2.31	1.74
Std. dev.	3.01	1.25	1,986	1,125	18,167	11,814	0.33	0.22
Std. error	1.74	0.72	1,147	650	10,489	6,821	0.19	0.13
Tentuliguda								
2011	75.5	51.2	55,870	50,176	46,055	18,944	1.82	1.38
2012	78.4	52.5	58,016	51,450	67,424	32,550	2.16	1.63
2013	82.5	50.8	61,050	49,784	83,325	39,116	2.36	1.79
Mean	78.8	51.5	58,312	50,470	65,601	30,203	2.12	1.60
Std. dev.	3.52	0.89	2,603	871	18,702	10,289	0.27	0.21
Std. error	2.03	0.51	1,503	503	10,797	5,940	0.16	0.12
Durkaguda								
2011	86.7	45.6	58,089	45,600	67,191	15,960	2.16	1.35
2012	88.1	51.3	59,027	51,300	79,853	30,780	2.35	1.60
2013	85.4	48.6	57,218	48,600	100,632	36,450	2.76	1.75
Mean	86.7	48.5	58,111	48,500	82,559	27,730	2.4	1.6
Std. dev.	1.35	2.85	905	2,851	16,884	10,580	0.31	0.20
Std. error	0.78	1.65	522	1,646	9,748	6,108	0.18	0.12
Luhaba								
2011	60.5	42.8	60,500	54,784	21,175	2,996	1.35	1.05
2012	65.5	38.6	65,500	49,408	39,300	12,352	1.60	1.25
2013	62.5	40.7	62,500	52,096	46,875	19,129	1.75	1.37
Mean	62.8	40.7	62,833	52,096	35,783	11,492	1.57	1.22
Std. dev.	2.52	2.10	2,517	2,688	13,206	8,101	0.20	0.16
Std. error	1.45	1.21	1,453	1,552	7,624	4,677	0.12	0.09
Kanjaimaliguda								
2011	70.2	43.5	55,107	54,375	39,663	4,350	1.72	1.08
2012	77.6	41.8	60,916	52,250	63,244	14,630	2.04	1.28
2013	72.3	42.6	56,756	53,250	69,770	21,300	2.23	1.40
Mean	73.4	42.6	57,593	53,292	57,559	13,427	2.00	1.25
Std. dev.	3.81	0.85	2,994	1,063	15,838	8,539	0.26	0.16
Std. error	2.20	0.49	1,728	614	9,144	4,930	0.15	0.09
Jhaliaguda								
2011	75.3	38.6	60,993	50,180	40,662	1,930	1.67	1.04
2012	71.4	42.5	57,834	55,250	56,406	12,750	1.98	1.23
2013	72.8	40.8	58,968	53,040	68,432	18,360	2.16	1.35
Mean	73.2	40.6	59,265	52,823	55,167	11,013	1.93	1.21
Std. dev.	1.98	1.96	1,600	2,542	13,926	8,352	0.25	0.16
Std. error	1.14	1.13	924	1,468	8,040	4,822	0.14	0.09

Sale price @ ₹ 1350, 1600 and 1750 q^{-1} in 2011, 2012 and 2013, respectively; Demo. : Demonstration; FP: Farmer's practice

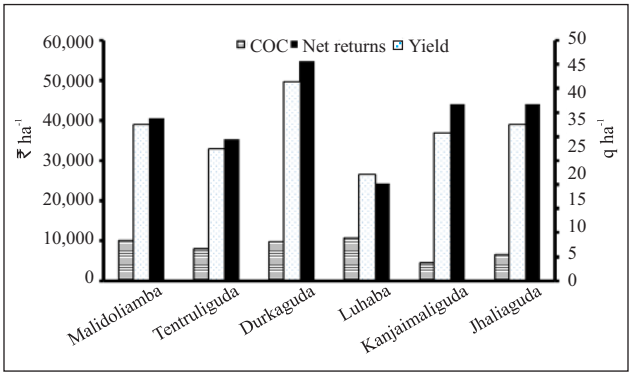

Fig. 3. Additional yield and economic returns in FLDs of different villages (Pooled data of 3 years)

about the ways and means of scientific resource conservation.

Survey data on sloping range of different villages is classified in Table 5. It incites that marigold cultivation is practiced on varying slopes of Eastern Ghat region and majority of farmers' field lies in uplands. Maximum surveyed farmers from Durkaguda village cultivate marigold on upper slopes (up to 11%), whereas marigold is cultivated on gentle slope of 2-3% in Malidoliamba village. Common conservation measures *viz.*, bunding, mulching and intercropping are seen in farmers' fields. However, the adoption and maintenance of conservation measures is very poor in Kanjaimaliguda village of Jeypore block whereas

Table: 5
Village wise slope, conservation measures and water use efficiency in FLD's (n =120)

S. No.	Village	Field slope (%)			Resource conservation measures	Water use efficiency (kg ha^{-1}mm)								
		2-4	4-8	8-11		2011	2012	2013	2011		2012		2013	
						Water use (mm)*			Demo.	FP	Demo.	FP	Demo.	FP
1	Malidoliamba	14	4	2	Contour cultivation	1,140	1,150	750	8.14	4.69	7.55	4.83	12.03	7.44
2	Tentuliguda	13	5	2	Bunding, Mulching	1,050	1,280	800	7.19	4.88	6.13	4.10	10.31	6.35
3	Durkaguda	4	7	9	Trenching, Contour Bunding	1,100	1,200	750	7.88	4.15	7.34	4.28	11.39	6.48
4	Luhaba	3	10	7	Across Slope Cultivation	1,180	1,240	680	5.13	3.63	5.28	3.11	9.19	5.99
5	Kanjaimaliguda	5	12	3	Vertical Mulching	840	1,250	760	8.36	5.18	6.21	3.34	9.51	5.61
6	Jhaliaguda	2	10	8	Nil	820	1,250	720	9.18	4.71	5.71	3.40	10.11	5.67
	Mean	7	8	5		1,022	1,228	743	7.65	4.54	6.37	3.84	10.42	6.25

*Consumptive water use

farmers of Jhaliaguda village had no conservation measure on sloping lands. The villages of Semiliguda block are adopting different measures according to slope conditions *viz.,* trenching and vertical mulching on greater slopes. The reason attributed to this is the proximity of government institutes and training attended by the farmers.

Data on consumptive water use of marigold for respective year is also presented in Table 5. On the basis of the crop duration in different years (2011-2013), the villages' crop water use showed wide variation. On mean value basis, seasonal water use varied from 930 to 1043 mm. Tentuliguda recorded the maximum values for mean water use (1043 mm) followed by Luhaba (1033 mm). Optimum water use leads to higher flower yield as it is reflected in marigold yield. WUE of marigold was 7.65, 6.37 and 10.42 kg ha^{-1}mm in demonstration plots and 4.54, 3.84 and 6.25 kg ha^{-1}mm in farmers' plots in 2011, 2012 and 2013, respectively. On mean value basis of all villages, the WUE under improved marigold cultivation was 68.5, 65.88 and 66.72% higher than local practice (FP) in 2011, 2012 and 2013, respectively. Higher values of WUE in demonstration plots stemmed from better plant nutrition and higher moisture availability. From the data, it is evident that use of improved technological practices has greatly enhanced the WUE of marigold crop in the demonstration plots over farmers' plots although the crop water use was the same under both the situations.

Consultancy Pattern of Marigold Cultivators

An effort was made to identify the information source of marigold farmers for scientific cultivation and on the basis of the obtained score ranking was done (Table 6). It was found that KVK/Research Station (OUAT) are the preferred source of knowledge across the villages in Koraput district. This is closely followed by agriculture seed (input) shop. Horticulture/Agriculture Officer and extension personnel of line departments, ICAR Institute were the other major agents in providing knowledge to marigold cultivators in the study area.

Table: 6
Information consultancy pattern of marigold growers(n=120)

S.No.	Source of information	Score	Rank
1	KVK/SAU's	28	I
2	Seed shop/Company agent	23	II
3	Horticulture Officer/Agri. Officer	20	III
4	Extension workers	14	IV
5	ICAR Institute	10	V
6	Radio	7	VI
7	Progressive farmer	5	VII
8	Krishi Mela	4	VIII
9	Cooperative society/bank	3	IX
10	Kisan call Centre/mobile	3	X
11	Television	2	XI
12	Youth club	1	XII

Information consultancy pattern of marigold growers revealed that mass media like radio and television were not the ideal sources of knowledge for them. This is accredited to high illiteracy rate in the villages and non-suitability of time to listen to the programs on agriculture or marigold production. Moreover, programs on marigold production technology are seldom broadcasted. The farmers appreciated the introduction of farm advisory services on mobile and getting solution of their problems. With the advent of mobile communication, selected farmers are calling to 'Kisan Call Centre' for solutions. Due to poor infrastructure facilities like electricity and connectivity, farmers hardly get information from electronic media. Poor coverage of marigold cultivation in local daily kept the newspaper at lower rank by the farmers. The results of this study agree with the findings of Reddy and Tirky (2004).

4. CONCLUSIONS

The study incites that knowledge and adoption behaviour of marigold growers was also greatly influenced by the KVK/SAU expertise, inferring that the institute support needs strengthening for its formation as hub of agrarian clientele. There is a need to improve the social participation of the flower cultivators by mobilizing them towards forming the self-help groups and to form co-

operative associations for better marketing. Extension agency contact should be strengthened for higher adoption of marigold production technologies among flower cultivators by using the mass media services.

Rural youth, young farmers and school dropouts should be given enough support by training and education so that they can adopt scientific marigold cultivation for better livelihood prospects. The cultivation of marigold with conservation measures improves crop performance and fetches good profits. The extension strategy should be of targeted approach towards the young farmers who possess high adoption rate of improved marigold cultivation and old age group farmers should be educated regarding these new profitable innovations.

REFERENCES

Anonymous. 2013. Annual Report 2012-13. Orissa University of Agriculture and Technology, Bhubaneswar. 54 p.

Anonymous. 2014a. *Pocket book on Agricultural Statistics.* Ministry of Agriculture, Govt. of India, 85, Institutional area, Sector 18, Gurgaon, 39 p.

Anonymous. 2014b. Odisha Rainfall Monitoring System. http:// as.ori.nic.in/ Koraput/ rainfall/ Pub. Rain Chart Dtl.asp.

Bhairamkar, M.S., Hardikar, D.P., Kadam, J.R. and Patil, V.G. 2011. *Quantification of variables and various scales in Extension Education.* Jain Brothers Publication, New Delhi.

Choudhary, A.K. and Suri, V.K. 2014. Scaling-up of Pulse Production under Frontline Demonstration Technology Transfer Program in Himachal Himalayas, India. *Comm. Soil Sci. Plant Ana.*, 45: 1934-1948.

Dass, A. and Sudhishri, S. 2008. A study of mushroom cultivation and growers in tribal watershed development in Orissa. *Int. J. Agric. Sci*., 4(1): 314-320.

Dass, A., Sudhishri, S., Lenka, N.K and Patnaik, U.S. 2011. Runoff capture through vegetative barriers and planting methodologies to reduce erosion, and improve soil moisture, fertility and crop productivity in southern Orissa, India. *Nut. Cycle Agroeco.,* 89(1): 45-57.

Dass, **A.**, Sudhishri, S., Patnaik, U.S. and Lenka, N.K. 2009. Effectof agronomic management on watershed productivity, impact indices, crop diversification and soil fertility in eastern ghats of Orissa. *J. Soil Water Cons.,* 8(3): 34-42.

Gowda, B.T., Angadi, J.G. and Hirevenkan, L.V. 2006. Adoption and marketing pattern of cut flowers in Belgaum District. *Karnataka J. Agric. Sci.,* 19(3): 603-608.

Maharana, J., Acharya, P., Swain, M. and Jakhar, P. 2012. Off-season Marigold Cultivation- A Profitable Enterprise in Koraput District of Odisha. (Abstracts) Conference on 'Livelihood and Environmental Security through Resource Conservation in Eastern Region of India (LESRC-2012)', Jakhar, P., Madhu, M., Hombe Gowda, H.C. and. Khan, M.K. (Eds.), p 67. Indian Association of Soil and Water Conservationists, Dehradun, Uttarakhand, April 5-7, 2012.

Reddy, T.M. and Tirkey, I. 2004. Assessing farmers' behaviour in adoption of improved technologies of vegetable crops in Karnataka. In Proceedings: *Impact of Vegetable Research in India,* National Centre for Agricultural Economics and Policy Research, New Delhi, pp. 143-149.

Sajeev, M.V. and Saroj, P.L. 2014. Technology utilization and its socio-economic determinants among cashew farmers of Karnataka. *Ind. Res. J. Ext. Edu.,*14(3): 59-65.

Sikka, A.K., Singh, D.V., Gadekar, H. and Madhu, M. 2000. Diagnostic survey and zonation of Eastern Ghats for Natural Resource Conservation and Management. Central Soil and Water Conservation Research and Training Institute, Research Centre, Ootacamund, India, 82 p.

Singh, B.K., Rakesh, E.S., Yadav, V.P.S. and Singh, D.K. 2010. Adoption of Commercial Cut Flower Production Technology in Meerut. *Ind. Res. J. Ext. Edu.,* 10(1): 50-53.

Tomar, L.S., Sharma, P.B. and Joshi, K. 2003. Study on Yield Gap and Adoption Level of Potato Production Technology in Grid Region. *Maha. J. Ext. Edu.*, 22(1): 15-18.

Vedna, K., Kumar, A. and Bhateria, S. 2007. Demonstration: An effective tool for increasing the productivity of rapeseedmustard in Kangra District of Himachal Pradesh. *Him. J. Agri. Res.,* 33(2): 257-261.

Verma, H.K., Patel, B.M., Patel, J.K. and Yadav. P. 2013b. Motives behind marigold cultivation of marigold growers in Anand District. *Int. J. Agri. Sci.,* 9(2): 593-59.

Verma, H.K., Patel, B.M. Patel, J.K. and Yadav.P.2013a.Constraints in adoption of marigold production technology. *Int. J. Agri. Sci.,* 8(1&2): 177-179.